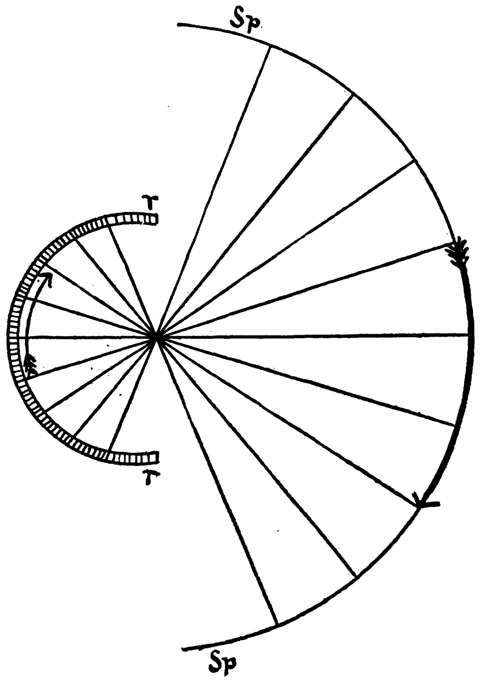
ray line to its own place; and thus the external image is *reinverted in the act of external reference*, and reconstructed in space in its true position as the sign and facsimile of the object that made it.

These facts will perhaps be made still clearer by the following diagram in which *r*, *r*, and *sp*, *sp*, represent the retinal and spatial concaves.



Every point, every rod and cone of the retina, *has its fixed correspondents in space*, and these correspondents *exchange* with one another by impression and external reference. The arrow and its retinal image are introduced to render the subject, if possible, still clearer. Although, indeed, I thought I had already made it sufficiently clear in my little book 'Sight,' pp. 83–89.

It is seen, then, that there are two fundamental laws underlying monocular vision: First, the law of external projection of retinal impressions into space. Second, the law of direction, *i. e.*, the mathematically definite direction of this projection. These two laws explain every phenomenon of monocular vision except *color perception.*

So again the apparent anomaly in Binocular vision of single vision with two retinal images is, it seems to me, easily explained so far as sense perception is explicable by science at all. Those who observe closely their visual phenomena know perfectly that except under well known conditions we *do* see *two objects* or *rather two external images* of every object, and we know perfectly well which corresponds to, or is produced by, each retinal image. We *see objects single only when these two external images of the same objects are placed one on the other and made to coincide.* This takes place when the two retinal images of the same object fall on what are called corresponding points of the two retinæ; because then, *by the law of direction* already explained, *they are thrown to the same place in space* and their external corresponding images coincide. Anyone accustomed to binocular experiments can at will separate these images and then bring them closer and closer, observing them the while, until they coalesce and the object is seen single. Is not this a sufficient explanation?

JOSEPH LE CONTE.

BERKELEY, CAL., October 17, 1895.

SCIENTIFIC LITERATURE.

A Text-book of Mechanics and Hydrostatics. By HERBERT HANCOCK, M. A., F. R. A. S., F. R. Met. Soc. New York, D. Van Nostrand Co. 1894. Pp. viii+409.

It goes without saying that the task of preparing a good elementary book on mechanics is now far easier than at any previous epoch in the history of the science. The clarification in fundamental ideas and the fixation of terminology which have come about during the past thirty years would seem to make it difficult for an author to depart very widely from sound definitions and logical development. It is somewhat surprising, therefore, to find a book whose author acknowledges his indebtedness to Maxwell, Thomson and Tait, and Clifford, marred by the very confusion of ideas which those eminent teachers have done so much to banish from mechanics.

Our suspicion of the author's fitness for his work is raised in the first paragraph of his preface, wherein he gravely affirms that "past experience leads me to conclude that no complete knowledge of mechanics can be got without some knowledge (however elementary) of

such subjects as plane trigonometry, variation and mensuration, etc., and with this in view I have premised the book by a simple statement of the methods of measuring angles, and the geometrical meanings of sine, cosine, etc., of an angle with simple explanation of the other operations." This might suffice to indicate the nature of the book, but it seems only fair to the public to give a few more specimens of the author's ideas. Naturally, we look to his chapters entitled 'Inertia and the Laws of Motion' and 'Energy and Work.'

In the former chapter, p. 83, we read, "From a large number of experiments we conclude that matter is incapable of changing its own state. This inert or passive condition is called the inertia of matter, and the law which regulates it is called the law of inertia." On p. 86, in reference to Maxwell's statement that "the change in momentum of a body is numerically equal to the impulse which produces it, and is in the same direction," the author remarks that "this law is sometimes called the law of impulse. We must be careful to distinguish between an impulse and impulsive force." Notwithstanding this caution, he says a few lines further on, "An impulse is a force which in a finite time produces a definite change of momentum." In the chapter on work and energy, p. 223, we are told "that there are many forms of energy, such as heat, light, chemical action, electricity, magnetism, etc. On this account the term mechanical energy is sometimes used to denote kinetic and potential energy." On p. 224, in explanation of a foot-poundal he tells us "this is sometimes called the absolute or kinetic unit of force. This unit," he adds, "was given by Newton, and it is probably the most accurate."

These illustrations, which might be easily multiplied to a wearisome extent, may serve to show the utterly chaotic character of the work in its treatment of fundamental principles. The author demonstrates clearly that if he has read the works of Maxwell, Thomson and Tait, etc., at all, he has read them to no purpose.

Mechanics (Dynamics). An Elementary Text-book, Theoretical and Practical, for Colleges and Schools. By R. T. GLAZEBROOK, M. A., F. R. S. Cambridge, at the University Press, New York, Macmillan & Co. 1895. Pp. xii.+256.

This little book on dynamics is one of the 'Physical Series of the Cambridge Natural Science Manuals.' It is the outgrowth of the author's experience in giving a practical course of lectures and laboratory work in mechanics to students of medicine. The result is one of the best elementary books we have seen—one well worth reading, in fact, by those who have passed beyond the elements of the science. "Mechanics" the author says, in his preface, "is too often taught as a branch of pure mathematics. If the student can be led up to see in its fundamental principles a development of the consequences of measurements he has made himself, his interest in his work is at once aroused, he is taught to think about the physical meaning of the various steps he takes and not merely to employ certain rules and formulæ in order to solve a problem." This gives the key to the plan of the book, and so well is the plan executed that even the dullest reader cannot fail to get instruction if he comes to the subject without erroneous preconceptions.

The book is divided into eleven chapters, which are characterized throughout by clearness and precision of statement and aptness of illustration. The first chapter deals with units and methods of measurement and with the terms used in mechanics. Chapters II and III are devoted to kinematics, the first to velocity and the second to acceleration. Chapters IV and V treat of momentum and the time rate of change of momentum respectively. The term *force*, concerning which there is commonly enough obscurity even with mechanicians, and a sort of abysmal profundity with those philosophers who are not naturalists, appears in Chapter V as the name for the rate of change of momentum.

These first five chapters furnish what the author considers a sufficient inductive foundation for the science. Thenceforth he proceeds by deduction chiefly. Thus, at the close of the fifth chapter he says: "We are now about to make a fresh start and consider Dynamics as an abstract science based on certain laws or axioms which were first clearly enunciated by Newton and are called Newton's Laws of Motion. We